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PATENT **00AB154/ALBRP204US**

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Date: October 31, 2005 Rebecca A. Bellas

Rebecca Bellas

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re patent application of:

Applicant(s): Dan Dotson, *et al.*

Serial No: 09/672,639

Filing Date: September 28, 2000

Examiner: Jin Cheng Wang

Art Unit: 2672

Title: RASTER ENGINE WITH PROGRAMMABLE MATRIX CONTROLLED GRAYSCALE DITHEREING

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APPEAL BRIEF

Dear Sir:

Appellants' representative submits this brief in connection with an appeal of the above-identified patent application. A credit card payment form is filed concurrently herewith in connection with all fees due regarding this appeal brief. In the event any additional fees may be due and/or are not covered by the credit card, the Commissioner is authorized to charge such fees to Deposit Account No. 50-1063 [ALBRP204US].

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I. Real Party in Interest (37 C.F.R. §41.37(c)(1)(i))

The real party in interest in the present appeal is Rockwell Technologies, LLC, the assignee of the present application.

II. Related Appeals and Interferences (37 C.F.R. §41.37(c)(1)(ii))

Appellants, appellants' legal representative, and/or the assignee of the present application are not aware of any appeals or interferences which may be related to, will directly affect, or be directly affected by or have a bearing on the Board's decision in the pending appeal.

III. Status of Claims (37 C.F.R. §41.37(c)(1)(iii))

Claims 1-14, 22-27 and 29-35 are currently pending in the subject application and are presently under consideration. Claims 15-21 and 28 have been cancelled. Claims 1-14, 22-27 and 29-35 stand rejected by the Examiner. The rejection of claims 1-14, 22-27 and 29-35 is being appealed.

IV. Status of Amendments (37 C.F.R. §41.37(c)(1)(iv))

Amendments have been made subsequent the Final Office Action dated March 25, 2005. Furthermore, such amendments were not entered by the Examiner.

V. Summary of Claimed Subject Matter (37 C.F.R. §41.37(c)(1)(v))

Independent Claim 1

Independent claim 1 recites a raster engine for interfacing a frame buffer in a computer system to a plurality of disparate display types over a single interface, comprising: at least one control register programmable via the computer system to select a display mode, a programmable grayscale generator that generates grayscale formatted data concurrently for a plurality of disparate display types and formats from pixel data in the frame buffer, wherein the grayscale generator generates grayscale data according to the selected display mode, and a logic device including a pixel shifting logic system with a YCrCb encoder and a DAC adapted to select appropriate pixel data from the grayscale

generator in accordance with a selected display mode to provide the selected pixel data to a single output wherein the single output can provide data to both CRTs and LCDs. (*See, e.g.*: page 5, lines 3-8; page 8, lines 24-31; page 9, lines 5-31 to page 10, lines 1-6; page 11, lines 12-26; page 12, lines 23-31; page 13, lines 7-10; page 17, lines 4-20; page 19, lines 3-10; page 35, lines 7-28; page 39, lines 13-31 to page 40, lines 1-16; page 43, lines 28-31 to page 44, lines 1-6; page 44, lines 7-11; page 44, lines 21-31 to page 45, lines 1-10; page 47, lines 3-20; *see also, generally,* Figures 1, 12, 14A, 14B, 17-20, 23-27, 31 and 32).

Independent Claim 22

Independent claim 22 recites a raster engine for interfacing a frame buffer in a computer system to one of a plurality of disparate display types, comprising means for selecting a display mode (*See, e.g.*: page 8, lines 24-31 to page 9, lines 1-4; page 11, lines 12-26; page 16, lines 23-25; page 34, lines 20-22; *see also, generally,* Figures 1, 12, 14A, 14B, 17-20, 23-27, 31 and 32), means for obtaining pixel data from the frame buffer and programmable via the computer system to generate grayscale formatted data concurrently for a plurality of disparate display types and formats including the selected display mode (*See, e.g.*: page 5, lines 3-8; page 8, lines 24-31; page 9, lines 5-31 to page 10, lines 1-6; page 11, lines 12-26; page 12, lines 23-31; page 13, lines 7-10; page 17, lines 4-20; page 19, lines 3-10; page 35, lines 7-28; page 39, lines 13-31 to page 40, lines 1-16; page 43, lines 28-31 to page 44, lines 1-6; page 44, lines 7-11; page 44, lines 21-31 to page 45, lines 1-10; page 47, lines 3-20; *see also, generally,* Figures 1, 12, 14A, 14B, 17-20, 23-27, 31 and 32). Independent claim 22 further recites means for buffering data transferred from the frame buffer to eliminate or reduce data underflow (*See, e.g.*: page 13, lines 11-18; page 17, lines 4-20; page 21, lines 5-20) and parallel output means for selecting appropriate pixel data from the means for obtaining pixel data for the selected display mode, and for providing the selected pixel data at a single parallel output according to the selected display mode, wherein the single output provides data to both CRTs and LCDs. (*See, e.g.*: page 5, lines 3-8; page 8, lines 24-31; page 9, lines 5-31 to page 10, lines 1-6; page 11, lines 12-26; page 12, lines 23-31; page 13, lines 7-10; page 17, lines 4-20; page 19, lines 3-10; page 35, lines 7-28; page 39, lines 13-31 to page 40, lines 1-16; page 43,

lines 28-31 to page 44, lines 1-6; page 44, lines 7-11; page 44, lines 21-31 to page 45, lines 1-10; page 47, lines 3-20; *see also, generally,* Figures 1, 12, 14A, 14B, 17-20, 23-27, 31 and 32).

The means for limitations described above are identified as limitations subject to the provisions of 35 U.S.C. §112 ¶6. The structures corresponding to these limitations are identified with reference to the specification and drawings in the above-noted parentheticals.

VI. Grounds of Rejection to be Reviewed (37 C.F.R. §41.37(c)(1)(vi))

A. Claims 1-14, 22-27 and 29-35 stand rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the enablement requirement.

B. Claims 1-27, 29, and 30-35 stand rejected under 35 U.S.C. §112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which appellants' regard as the invention.

C. Claims 1-14 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Tjandrasuwita, (US 6,198,469) in view of Reddy, *et al.*, (US 6,215,459), and Hannah, (US 5,568,192).

D. Claims 22-27 and 30-35 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Tjandrasuwita, in view of Reddy, *et al.*, and Dye, (US 4,965,559).

E. Claim 29 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Tjandrasuwita, in view of Reddy, *et al.*, Hannah, and Dye.

VII. Argument (37 C.F.R. §41.37(c)(1)(vii))

A. Rejection of Claims 1-14, 22-27, 29, 30-35 Under 35 U.S.C. §112, first paragraph

Claims 1-14, 22-27, 29, and 30-35 are rejected under 35 U.S.C. §112, first paragraph, as failing to comply with the enablement requirement. Appellants' representative respectfully requests reversal of the rejection for at least the following reasons.

In particular, independent claims 1 and 22 recite "***generates*** grayscale formatted data concurrently for a plurality of disparate display types and formats ***from pixel data in the frame buffer***, wherein the grayscale generator generates grayscale data according to the selected display mode." The grayscale generator generates grayscale formatted data according to the selected display mode and does so ***concurrently*** from pixel data in the frame buffer. Examiner contends the language is not enabling to one of ordinary skill in the art. Appellants' representative disagrees because the Examiner is misconstruing the claim language. The adverb "concurrently" is descriptive of at least one verb. In regards to independent claims 1 and 22, the grayscale formatted data is **generated** for the selected display mode from pixel data in the frame buffer. Thus, the adverb "concurrently" applies to the verbs generates and where the data is generated from (pixel data in the frame buffer). That is, ***the generation of the grayscale data for the selected display mode is concurrently generated from pixel data in the frame buffer.***

Furthermore, the Examiner, in the Advisory Action dated July 28, 2005, interpreted independent claims 1 and 22 (and any claims dependent thereupon) as being non-enabling to one of ordinary skill in the art. Yet, the Examiner has read limitations from the specification into independent claims 1 and 22. It should be noted that while the claims can be read in light of the specification; the limitations from the specification cannot be read or introduced into the claims.

Moreover, the specification can define terms utilized within the claim. Here, the Examiner states that selected pixel data is provided to a single output over a single interface, wherein the single interface can be a parallel output having appropriate PINS on the interface. (*See* Advisory Action dated July 28, 2005). The various PINS

associated with a parallel output are to be included with the claim based upon the definition of the term "single interface." The single interface can include various PINS such as a parallel output. Interface is the entire entity that transmits the signal, while a PIN is not an interface. Accordingly based on the above, reversal of this rejection is respectfully requested.

B. Rejection of Claims 1-27, 29, and 30-35 Under 35 U.S.C. §112, second paragraph

Claims 1-27, 29, and 30-35 stand rejected under 35 U.S.C. §112, second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicants' regard as the invention. Appellants' representative respectfully requests reversal of the rejection for at least the following reasons.

Independent claims 1 and 22 recite "***generates*** grayscale formatted data ***concurrently*** for a plurality of disparate display types and formats ***from pixel data*** in the frame buffer, wherein the grayscale generator ***generates grayscale data*** according to the selected display mode." The adverb "concurrently" is descriptive of at least one verb. In regards to independent claims 1 and 22, the grayscale formatted data is **generated** for the selected display mode from pixel data in the frame buffer. Thus, the adverb "concurrently" applies to the verb generates and where the data is generated from (pixel data in the frame buffer). That is, ***the generation of the grayscale data for the selected display mode is concurrently generated from pixel data in the frame buffer.***

Furthermore, the Examiner, in the Advisory Action dated July 28, 2005, interpreted independent claims 1 and 22 (and any claims dependent thereupon) as not particularly pointing out and distinctly claiming the subject matter regarding the invention. Yet, the Examiner has read limitations from the specification into independent claims 1 and 22. It should be noted that while the claims can be read in light of the specification; the limitations from the specification can never be read or introduced into the claims.

The Examiner states that selected pixel data is provided to a single output over a single interface, wherein the single interface can be a parallel output having appropriate PINS on the interface. (*See* Advisory Action dated July 28, 2005). The various PINS

associated with a parallel output are to be included with the claim based upon the definition of the term "single interface." The single interface can include various PINS such as a parallel output. Interface is the entire entity that transmits the signal, while a PIN is not an interface. Accordingly based on the above, reversal of this rejection is respectfully requested.

C. **Rejection of Claims 1-14 Under 35 U.S.C. §103(a)**

Claims 1-14 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Tjandrasuwita, (US 6,198,469) in view of Reddy, *et al.*, (US 6,215,459), and Hannah, (US 5,568,192). Reversal of this rejection is respectfully requested for at least the following reasons. Neither Tjandrasuwita, Reddy, *et al.*, nor Hannah alone or in combination teach or suggest the claimed invention.

> To reject claims in an application under §103, an examiner must establish a *prima facie* case of obviousness. A *prima facie* case of obviousness is established by a showing of three basic criteria. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) ***must teach or suggest all the claim limitations.*** *See* MPEP §706.02(j). The ***teaching or suggestion to make the claimed combination*** and the reasonable expectation of success ***must both be found in the prior art and not based on applicant's disclosure.*** *See In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991) (emphasis added).

In particular, independent claim 1 recites a programmable grayscale generator that ***generates grayscale data for a plurality of disparate display types and formats.*** Tjandrasuwita teaches the generation of grayscale data in response to input color data - Tjandrasuwita does not teach or suggest generating grayscale data for ***a plurality of disparate display types and formats*** as in appellants' claimed invention. By invoking the flat panel interface 113, Tjandrasuwita provides grayscale data to various digital display types having the same or common refresh rate. Similarly, Reddy, *et al.* teaches a

controller that provides data to two displays having the same or common refresh rate simultaneously. On the contrary, appellants' claimed invention generates grayscale data for a plurality of disparate display types (*e.g.*, LCD, CRT, TFT, flat panel, STN, ...) having a plurality of disparate display formats (*e.g.*, color, monochrome, resolution, refresh rate, *etc.*) without the rerouting of signals outside the raster engine allowing video data to be provided to a wide variety of different displays with different color capabilities and resolutions. Nowhere in Tjandrasuwita nor Reddy, *et al.* is generating data for a plurality of disparate display types and respective disparate formats taught or suggested. Furthermore, Hannah does not cure the aforementioned deficiencies of Tjandrasuwita and Reddy, *et al.* with regard to such claimed aspects.

As disclosed in the specification, the subject raster engine is programmable to support many different and disparate display types over the same interface (See page 9, lines 3-5, and Fig. 31). Accordingly, the engine can support, *inter alia*, analog CRTs, analog LCDs, as well as digital LCDs. Conventional raster engines and video controllers require manual rerouting of signal connections to interface different display formats, whereas the present invention provides for universal connectivity (See page 9, lines 23-26). Although, Tjandrasuwita does provide support for both LCDs and CRTs, it merely does so in a conventional manner. As shown in Figure 1, Tjandrasuwita provides separate outputs from the computer system for a CRT and an LCD wherein the LCD output is routed through a separate flat-panel interface. Therefore, Tjandrasuwita does not teach or suggest claim 1 at least because Tjandrasuwita does not disclose providing selected pixel data at a single output, wherein the output can provide signals to both CRTs and LCDs, as recited by the claim. Furthermore, claim 1 is not rendered obvious by Tjandrasuwita at least because Tjandrasuwita is not concerned with providing universal connectivity, but rather teaches a frame rate modulation technique for passive matrix LCDs.

Furthermore, independent claim 1 recites a ***single output*** that can provide data to both CRTs and LCDs ***over a single interface.*** Tjandrasuwita discloses two different physical connection points – one for CRTs and one for LCDs. LCDs are connected and receive data from a flat panel interface 113 (wherein the grayscale data is generated), while CRTs connect and receive data from a DAC (Digital-to-Analog Converter) external

to both the controller and the flat panel interface (wherein no grayscale data is generated). (*See* col. 4, 62-67 through col. 5, lines 1-10). In particular, although a single output is transmitted to a single device in Tjandrasuwita, the signal is transmitted *via* two disparate interfaces based upon the display type. The Examiner mistakenly contends that the grayscale output signal for an LCD *via* the flat panel interface 113 and the digital-to-analog converted signal for a CRT *via* the graphics controller share the same output, yet the same output cannot be over a single interface. Specifically, the Examiner states that Tjandrasuwita passes the same data to the two output data lines. (*See* pg. 8, lines 5-7 of the Final Office Action). Yet, the data targeted for an LCD is generated grayscale, while data targeted for the CRT is simply converted from digital-to-analog (*e.g.*, grayscale data is not generated).

Reddy, *et al.* discloses a single controller that can provide data to two different displays simultaneously. Thus, Reddy, *et al.* teaches one controller that controls ***two distinctly connected displays*** (*e.g.*, CRT and LCD) over ***two distinctive interfaces,*** thereby allowing switching between images on one display with images on another. Hence, neither Tjandrasuwita nor Reddy, *et al.* teach providing the selected pixel data to a ***single output over a single interface*** for both CRTs and LCDs as claimed. In addition, Hannah does not cure the aforementioned deficiencies with regard to the claimed limitations.

Dependent claim 3 states the grayscale look up table comprises a ***three dimensional matrix***. Examiner states Tjandrasuwita teaches or suggests such three dimensional matrix as claimed. On the contrary, Tjandrasuwita discloses two tables (Table 1 and Table 2), wherein Table 1 includes FRCLEVEL data (which indicates whether 2, 3, 8, or 16 levels of gray scaling are desired) and Table 2 includes brightness-level waveform data (each waveform is indicative of the average brightness of the pixel over 16 frames). Moreover, the three dimensional matrix in the subject application includes a frame dimension, a vertical dimension, and a horizontal dimension. Nowhere in Tjandrasuwita, Reddy, *et al.*, nor Hannah is a three dimensional matrix within a grayscale look up table taught or suggested, let alone the specific dimensions recited in such dependent claim.

In view of at least the aforementioned reasons, the subject invention as recited in independent claim 1 (of which claims 2-14 respectfully depend therefrom) is not obvious over Tjandrasuwita, Reddy, *et al.* and Hannah taken individually or in combination. Accordingly, this rejection should be reversed.

D. Rejection of Claims 22-27 and 30-35 Under 35 U.S.C. §103(a)

Claims 22-27 and 30-35 stand rejected under 35 U.S.C. §103(a) as being unpatentable over Tjandrasuwita, in view of Reddy, *et al.*, and Dye, (US 4,965,559). Appellants' representative respectfully requests this rejection be withdrawn for at least the following reasons.

Neither Tjandrasuwita, Reddy, *et al.*, nor Dye alone or in combination teach or suggest each and every aspect of appellants' invention. Specifically, claim 22 recites generating ***grayscale data for a plurality of disparate display types and formats***. As stated above, neither Tjandrasuwita nor Reddy, *et al.* teach or suggest generating data for a plurality of disparate display types and respective disparate formats. Rather, Tjandrasuwita and Reddy, *et al.* disclose providing grayscale data to various digital display types having the same or common refresh rate and a controller that provides data to two displays having the same or common refresh rate simultaneously, respectively. Appellants' claimed invention generates grayscale data for a plurality of disparate display types (*e.g.*, LCD, CRT, TFT, flat panel, STN, ...) having a plurality of disparate display formats (*e.g.*, color, monochrome, resolution, refresh rate, *etc.*) allowing video data to be provided to a wide variety of ***different displays with different color capabilities and resolutions***. Tjandrasuwita and Reddy, *et al.* do not teach or suggest such claimed aspects and Dye does not cure these aforementioned deficiencies.

As disclosed in the specification, the subject raster engine is programmable to support many different and disparate display types (*e.g.*, display modes) over the same interface (See page 9, lines 3-5, and Fig. 31). Accordingly, the engine can support analog CRTs, analog LCDs, as well as digital LCDs. Conventional raster engines and video controllers require manual rerouting of signal connections to interface different display formats, whereas the subject invention provides for universal connectivity (See page 9, lines 23-26). Tjandrasuwita does provide support for both LCDs and CRTs, it does so in

a conventional manner. As shown in figure 1, Tjandrasuwita provides separate outputs from the computer system for a CRT and an LCD wherein the LCD output is routed through a separate flat-panel interface. Therefore, Tjandrasuwita does not teach or suggest claim 22 at least because Tjandrasuwita does not disclose providing selected pixel data at a parallel output according to a selected display mode as recited by the claim. Accordingly, claim 22 (as well as claims 23-27 and 29 depending, respectively, therefrom) is allowable and reversal of this rejection is respectfully requested.

Moreover, claim 22 recites ***a parallel output*** that provides the selected pixel data at a ***single parallel output*** according to the selected display mode. Nowhere in Tjandrasuwita nor Reddy, *et al.* is a single output disclosed, let alone a single parallel output. The multiplexor 208 (of which the Examiner contends is a parallel output) is a selector between two signals (one for the TFT module 206 and the other for the STN module 207) that are generated for grayscale on an LCD. The multiplexor 208 merely selects between the two signals based on the LCD type that the grayscale is to be generated, and does not generate the data in parallel. Tjandrasuwita generates grayscale for LCDs exclusively; the multiplexor 208 is within the flat panel interface 113 which is a completely disparate signal in comparison to the converted (digital-to-analog) signal transmitted to CRT's *via* the display graphics controller. Thus, it is unforeseeable how the Examiner contends the multiplexor 208 to be a ***single parallel output*** as depicted in appellants' claimed invention. Tjandrasuwita does not teach or suggest ***a single parallel output*** as recited in independent claim 22. Additionally, Reddy, *et al.*, nor Dye cures the above mentioned deficiencies and reversal of this rejection is respectfully requested.

As stated above, neither Tjandrasuwita nor Reddy, *et al.* alone or in combination teach or suggest appellants' claimed invention as recited in independent claim 1 (or claims 30-35, which depend therefrom). Neither Tjandrasuwita nor Reddy, *et al.* teach or suggest a programmable grayscale generator that ***generates grayscale data for a plurality of disparate display types and formats***. Moreover, Dye does not cure the aforementioned deficiencies of Tjandrasuwita and Reddy, *et al.*

In addition, dependent claims 33 and 34 utilize an underflow system that generates an ***interrupt based on a detected or predicted underflow condition***, wherein a host processor can balance bus load and/or limit burst sizes to reduce undesirable visual

effects. Dye simply discloses a multi-channel display system that manages the driving of multiple displays. The interrupt in Dye does is not based on a detected or predicted underflow condition of a raster engine but rather it is based upon VME bus status, wherein the status is determined upon various user application programs and/or the VME host. In other words, the interrupts disclosed in Dye are to determine priority of the user application programs and/or the VME host such that priority allows transmission of data to the multi-display system to drive multiple displays. (*See* Fig. 2 and col. 2, lines 4-21). Nowhere in Dye is an interrupt ***generated based on a detected or predicted underflow condition***. Moreover, the aforementioned deficiencies of Dye are not cured by Tjandrasuwita and Reddy, *et al.*

In view of at least the foregoing, appellants' invention as recited in independent claims 1 and 22 (of which claims 23-27, 29-35 depend upon) is not obvious in view of the cited art. Accordingly, reversal of this rejection is respectfully requested.

E. Rejection of Claim 29 Under 35 U.S.C. §103(a)

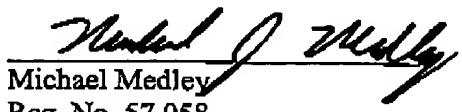
Claim 29 stands rejected under 35 U.S.C. §103(a) as being unpatentable over Tjandrasuwita, in view of Reddy, *et al.*, Hannah, and Dye. Claim 29 depends from independent claim 22. As stated *supra*, Tjandrasuwita, Reddy, and Hannah do not teach or suggest applicants' invention as recited in this independent claim; and Dye does not cure the aforementioned deficiencies of these references. Accordingly, this rejection should be reversed.

F. **Conclusion**

For at least the above reasons, the claims currently under consideration are believed to be patentable over the cited references. Accordingly, it is respectfully requested that the rejections of claims 1-14, 22-27 and 29-35 be reversed.

If any additional fees are due in connection with this document, the Commissioner is authorized to charge those fees to Deposit Account No. 50-1063.

Respectfully submitted,
AMIN & TUROCY, LLP



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VIII. Claims Appendix (37 C.F.R. §41.37(c)(1)(viii))

1. A raster engine for interfacing a frame buffer in a computer system to a plurality of disparate display types over a single interface, comprising:

at least one control register programmable via the computer system to select a display mode;

a programmable grayscale generator that generates grayscale formatted data concurrently for a plurality of disparate display types and formats from pixel data in the frame buffer, wherein the grayscale generator generates grayscale data according to the selected display mode; and

a logic device including a pixel shifting logic system, a YCrCb encoder, and a DAC adapted to select appropriate pixel data from the grayscale generator in accordance with a selected display mode, and to provide the selected pixel data to a single output, wherein the single output can provide data to both CRTs and LCDs.

2. The raster engine of claim 1, further comprising a grayscale look up table control register programmable by the computer system, and wherein the grayscale generator comprises a grayscale look up table programmable by the computer system using the grayscale look up table control register.

3. The raster engine of claim 2, wherein the grayscale look up table comprises a three dimensional matrix having a frame dimension, a vertical dimension, a horizontal dimension, and a plurality of data entries associated with each combination of frame, vertical, and horizontal dimensions, and wherein the data entries comprise a plurality of matrix position enable bits adapted to indicate whether a pixel in the display is energized.

4. The raster engine of claim 3, wherein the grayscale generator further comprises a frame counter, a vertical counter, and a horizontal counter, and wherein the grayscale look up table data entries define dithering operation for a pixel value according to the frame counter, the vertical counter, and the horizontal counter.

5. The raster engine of claim 4, wherein the frame dimension comprises one of 3 and 4, wherein the vertical dimension comprises one of 3 and 4, and wherein the horizontal dimension comprises one of 3 and 4.

6. The raster engine of claim 5, wherein the grayscale generator is adapted to translate 3 bits of pixel data for a pixel in the display to generate grayscale formatted data for the pixel to provide 8 shades of gray according to the selected display mode and the grayscale lookup table data entries.

7. The raster engine of claim 3, wherein the frame dimension comprises one of 3 and 4, wherein the vertical dimension comprises one of 3 and 4, and wherein the horizontal dimension comprises one of 3 and 4.

8. The raster engine of claim 1, wherein the grayscale generator is adapted to translate 3 bits of pixel data for a pixel in the display to generate grayscale formatted data for the pixel to provide 8 shades of gray according to the selected display mode.

9. The raster engine of claim 1, wherein the grayscale generator comprises a frame counter, a vertical counter, and a horizontal counter.

10. The raster engine of claim 6, wherein the grayscale generator is programmable by a user via an application program in the computer system.

11. The raster engine of claim 10, wherein the application program is a video driver.

12. The raster engine of claim 1, wherein the grayscale generator is programmable by a user via an application program in the computer system.

13. The raster engine of claim 6, wherein the display type is one of a monochrome display, a liquid crystal display, and an electro-luminescent display.

14. The raster engine of claim 1, wherein the display type is one of a monochrome display, a liquid crystal display, and an electro-luminescent display.

15-21. (Cancelled).

22. A raster engine for interfacing a frame buffer in a computer system to one of a plurality of disparate display types, comprising:

means for selecting a display mode;

means for obtaining pixel data from the frame buffer and programmable via the computer system to generate grayscale formatted data concurrently for a plurality of disparate display types and formats including the selected display mode;

means for buffering data transferred from the frame buffer to eliminate or reduce data underflow; and

parallel output means for selecting appropriate pixel data from the means for obtaining pixel data for the selected display mode, and for providing the selected pixel data at a single parallel output according to the selected display mode, wherein the single output provides data to both CRTs and LCDs.

23. The raster engine of claim 22, further comprising a grayscale look up table control register programmable by the computer system, and wherein the means for obtaining pixel data comprises a grayscale look up table programmable by the computer system using the grayscale look up table control register.

24. The raster engine of claim 23, wherein the grayscale look up table comprises a three dimensional matrix having a frame dimension, a vertical dimension, a horizontal dimension, and a plurality of data entries associated with each combination of frame, vertical, and horizontal dimensions, and wherein the data entries comprise a plurality of matrix position enable bits adapted to indicate whether a pixel in the display is energized.

25. The raster engine of claim 24, wherein the means for obtaining pixel data further comprises a frame counter, a vertical counter, and a horizontal counter, and wherein the grayscale look up table data entries define dithering operation for a pixel value according to the frame counter, the vertical counter, and the horizontal counter.

26. The raster engine of claim 25, wherein the means for obtaining pixel data is adapted to translate 3 bits of pixel data for a pixel in the display to generate grayscale formatted data for the pixel to provide 8 shades of gray according to the selected display mode and the grayscale lookup table data entries.

27. The raster engine of claim 24, wherein the frame dimension comprises one of 3 and 4, wherein the vertical dimension comprises one of 3 and 4, and wherein the horizontal dimension comprises one of 3 and 4.

28. (Cancelled).

29. The raster engine of claim 22, the parallel output means comprising two or more of a pixel shifting logic system, a YCrCb encoder, and a DAC.

30. The raster engine of claim 1, wherein the pixel shifting logic system receives pixel data from a multiplexer and presents the selected pixel data at a parallel output in accordance with the selected display mode.

31. The raster engine of claim 1, further comprising an underflow system that buffers data transferred to the grayscale generator from the frame buffer to eliminate or reduce data underflow conditions.

32. The raster engine of claim 31, wherein the underflow system comprises a dual port RAM device and a pixel multiplexer that selects pixel data from the dual port RAM device according to a selected display mode.

33. The raster engine of claim 31, wherein the underflow system generates an interrupt based on a detected or predicted underflow condition.

34. The raster engine of claim 33, wherein a host processor receives the generated interrupt and balances bus load and/or limits burst sizes to reduce or minimize undesirable visual effects associate with a starved or empty raster engine.

35. The raster engine of claim 1, further comprising a video stream signature analyzer to enable self testing.

IX. Evidence Appendix (37 C.F.R. §41.37(c)(1)(ix))

None.

X. Related Proceedings Appendix (37 C.F.R. §41.37(c)(1)(x))

None.